

Safe Working Practices for SNL/NM Center 1100

Part A: PHS Information

PHS Identification

PHS-SNL10A00226-001 CINT Rms: 1532 and 1533 – Flex Bay, Diffusion Area

Hazard Classification: Low

NEPA SNA07-0202 - CINT Integration Laboratories (1501, 1504, 1523, 1525, and 1527)

NEPA SNA10-0201 – CINT Building 518/1532 Installation and Operation of Low Pressure Chemical Vapor Deposition Furnace.

This completed SWP meets the requirements of a Job Safety Assessment as specified by the Work Planning and Controls manual.

Laboratory Owner

John Nogan, 1132, 284-8863

Brief Description of R&D Work Performed in this Laboratory

Chemical Vapor Deposition (CVD) is a chemical process used to deposit high-quality thin film dielectric materials onto a variety of surfaces. The process is often used for microelectronic and MEMS (Micro Electrical Mechanical System)/NEMS (Nano Electrical Mechanical Systems) fabrication. In a typical CVD process, the wafer (substrate) is exposed to one or more volatile precursors, which react and/or decompose on the substrate surface to produce the desired thin film material. Low pressure CVD (LPCVD) is a process that is performed at a subatmospheric pressure typically less than 1Torr. Reduced pressure tends to reduce unwanted gas-phase reactions and improve uniformity across the wafer. Thermal Oxidation is an atmospheric pressure process where a silicon substrate is exposed to an oxygen enriched environment at high temperature for the purpose of growing a high quality silicon dioxide thin film. This dielectric is commonly used for the fabrication of a variety of microelectronic and MEMS/NEMS type devices. The oxidation process can be accelerated by introducing steam into the oxidation chamber. Oxidation processed typically run for several hours however thicker films in the order of several microns can take several days or even weeks.

The IL's LPCVD/Thermal Oxidation furnace consists of four (4) separate chambers (horizontal tubes). Each tube serves a different process, tube #1 supports Wet/Dry Thermal Oxidation and Forming Gas Anneal up to 1100C, tube # 2 supports both stoichiometric and low stress SiN (Silicon Nitride) deposition up to 900C, tube #3 supports amorphous and polysilicon up to 800C, and tube #4 supports TEOS SiO₂ (Silicon Dioxide) deposition up to 800C.

Part B: Operations Identification, Hazards and Mitigation

Short Title of Laboratory Operations Category: Chemical Usage

Rigor Level: Low

Description of Laboratory-Specific Operations that Involves Chemical Hazards:

Toxic Gas: Disilane (Dichlorosilane or DCS), 100% Silane, and Ammonia.

DCS, Silane and Ammonia are stored and delivered from ventilated, fully automatic gas cabinets. Toxic gas monitoring sensor and fire detectors are also incorporated into the gas cabinets, furnace source cabinet and chase to detect the presents of an uncontained gas leak. If a leak or fire is detected, the tool is placed into a fail-safe condition and the toxic gasses are shut off at the bottle. TEOS is stored in a ventilated enclosure within the tool. The TEOS is not monitored by the tool or facility's TGMS.

Baseline Occupational Exposure Assessments were completed and are listed below:

ER2007-2559, 1501, 7/13/07

ER2007-2552, 1504, 7/3/07

ER2007-2630, 1525, 7/20/07

ER2007-2689, 1527, 8/1/07

ER2007-2646, 1522/1523, 7/24/07

ER2007-1696, 1501, 1/11/07

Exposure Assessment Survey Reports:

SNLNM02759, 1525, 11/9/10

SNLNM02783, 1522, 11/10/10

SNLNM02763, 1523, 11/9/10

Conclusions stated that exposure controls are adequate for laboratory operations.

All activities that involve chemicals will follow the laboratory practices outlined in SNL/NM Center SOP1100.00 Standard Operating Procedure for Working with Hazardous and Particularly Hazardous Chemicals in Center 1100 Laboratories.

Applicable Technical Work Documents:

- SOP1100.001 Standard Operating Procedure for Working with Hazardous and Particularly Hazardous Chemicals in SNL/NM Center 1100 Laboratories

These documents are required reading for all authorized workers.

Required Training:

- ESH100 ES&H Awareness
- CHM100 Chemical Safety Training
- CHM103 Site-Specific Chemical Safety Training
- ENV112 Hazardous Waste and Environmental Management
- ILUA Integrated Lab Unescorted Assess Training

These courses are required training for all authorized workers.

Possible Chemical Hazards:

- Inhalation during servicing or cylinder exchange.

Mitigation of Chemical Hazards:

- Engineering controls to include fully automatic gas cabinet which allows operator to maintain control of gases outside of the hazardous area.
- Air purifying respirator

Short Title of Laboratory Operations Category: Environmental	
Rigor Level: Low	
Description of Laboratory Operations Category: Effluent from Tubes 2, 3 and 4 are directed through a two-stage dynamic oxidation and water scrub abatement system. Tube 2 is processed through both stages to react/collect solids and then neutralize the DCS and NH ₃ . Tube 3 is processed through the dynamic oxidation stage to react the Silane with air in order to form SiO ₂ . The SiO ₂ is then trapped in a particulate filter. Tube 4 is only processed through the dynamic oxidation stage to collect any particulate; the byproduct of TEOS is ethanol.	
Applicable Technical Work Documents: <ul style="list-style-type: none"> SOP1100.001 Standard Operating Procedure for Working with Hazardous and Particularly Hazardous Chemicals in SNL/NM Center 1100 Laboratories 	Required Training: <ul style="list-style-type: none"> CHM100 Chemical Safety Training CHM103 Site-Specific Chemical Safety Training ENV112 Hazardous Waste and Environmental Management. ILUA Integrated Lab Unescorted Assess Training
These documents are required reading for all authorized workers.	These courses are required training for all authorized workers.
Resulting Hazards: <ul style="list-style-type: none"> Bodily injury Environmental Concern 	Mitigation of Identified Hazards: Solvent contaminated wipes, swabs, and gloves will be disposed of in the trash receptacles marked Solvent. Dried wipes of evaporated acetone, isopropanol, or methanol may be disposed of in the non-hazardous trash.

Short Title of Laboratory Operations Category: Mechanical hazards	
Rigor Level: Low	
Description of Laboratory Operations Category: Portable power tools are used occasionally during operations.	
Applicable Technical Work Documents: <ul style="list-style-type: none"> N/A 	Required Training: <ul style="list-style-type: none"> ESH100 ES&H Awareness ILUA Integrated Lab Unescorted Assess Training
These documents are required reading for all authorized workers.	These courses are required training for all authorized workers.
Resulting Hazards: <ul style="list-style-type: none"> Hand injury Electrical 	Mitigation of Identified Hazards: On-the-Job training is conducted if necessary by personnel.

Continuous Improvement and Feedback

This SWP document must be reviewed, revised (if necessary), and re-signed at least annually in conjunction with PHS renewal. This SWP must be revised earlier in response to:

- new hazards (e.g. chemicals) being introduced in to the laboratory,
- recognition of hazards not previously considered, or
- identification of significant improvements to hazard control/mitigation defined in this document, and other situations where improvement to laboratory safety should be documented. It should be noted that these same conditions may require revision of the laboratory PHS and required training matrix.

Reviews and Approval

Prepared by Laboratory Owner

John Nogan

Printed Name

Signature

Date

Reviewed by CINT ES&H Coordinator

Michael Starr

Printed Name

Signature

Date

_____ Center ES&H Coordinator initials here designate that further review by Industrial Hygiene or other Subject Matter Experts is not required.

Reviewed by Center Industrial Hygienist as required

Printed Name

Signature

Date

Additional SME Review required by Center ES&H Coordinator or Department Manager

Reviewer

Title/Activity

Signature

Date

Additional SME Review required by Center ES&H Coordinator or Department Manager

Reviewer

Title/Activity

Signature

Date

Approved by Department Manager

By approving the SWP, the Department Manager attests that it is an appropriate assessment of the ES&H risks associated with the R&D activities that are authorized to take place in the designated lab(s). The approval signature further indicates that the hazard mitigations specified in this SWP are also appropriate.

Sean Hearne

Printed Name

Signature

Date

Laboratory Authorization Sheet:

Signature by the Authorized Workers in the following Summary Authorization Table certify that the worker has read, understood, and agree to follow the Safe Working Practices identified in this document. Authorized Workers agree that they will not introduce hazards into this laboratory that are not covered by the PHS, SWP, and related documents.”

If a new MOW is brought in to work in the laboratory, their training must be evaluated by the Manager or Lab Owner prior to any work being assigned or conducted. Their signature asserts that this has been done.

Printed Name	Signature	Date	Lab Owner Confirm. (initials)	Chemical Operations	Environmental	Mechanical Hazards									
<i>Rigor Level</i>				<i>L</i>	<i>L</i>	<i>L</i>									